Air Toxics in Indiana

Analysis of Selected Toxic Air Pollutants Monitored from 1999 to 2001

The ToxWatch Study did not include an exposure assessment. Therefore, the contents of this report should not be construed to imply or represent any specific findings with respect to risks associated with exposure to monitored pollutants.

Prepared by
Indiana Department of Environmental Management
Office of Air Quality

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John Welch conducted the bulk of the research needed to complete this Study and is the primary author of this report. Questions and comments should be directed to him by e-mail at jwelch@dem.state.in.us or by calling 317-233-5677.

PART I INTRODUCTION

SECTION 1.0 OVERVIEW

In 1999, the Indiana Department of Environmental Management, Office of Air Quality (OAQ) began a two-year monitoring study, called “ToxWatch.” The Study established air toxics monitoring stations in four urban areas with the highest reported releases of toxic air pollutants according to the US Environmental Protection Agency’s Toxics Release Inventory (TRI). From June 1, 1999 to June 30, 2001, OAQ monitored air toxics by analyzing air samples from monitors in Elkhart County, Indianapolis (Marion County), Northwest Indiana (Lake and Porter Counties) and Evansville (Posey and Vanderburgh Counties). This report summarizes findings of the ToxWatch Study and presents recommendations for follow-up activities.

Air samples were analyzed for 56 pollutants, including 29 pollutants that are identified as hazardous air pollutants in the Clean Air Act. The other 27 pollutants were analyzed because of their role in ground level ozone formation. The hazardous air pollutants (or “air toxics”) analyzed in the Study are:

Benzene
Bromomethane (Methyl Bromide)
Carbon Tetrachloride
Chlorobenzene
Chloroethane (Ethyl Chloride)
Chloroform (Trichloromethane)
Chloromethane (Methyl Chloride)
Cumene (Isopropylbenzene)
1, 2 Dibromoethane (Ethylene Dibromide)
1, 4 (para) Dichlorobenzene
1, 1 Dichloroethane
1, 2 Dichloroethane (Ethylene Dichloride)
Dichloromethane (Methylene Chloride)
1, 2 Dichloropropane (Propylene Dichloride)
1, 3 Dichloropropene
Ethyl Benzene
Hexachlorobutadiene (Perchlorobutadiene)
Hexane
methyl chloroform (1, 1, 1-Trichloroethane)
Perchloroethylene (Tetrachloroethylene)
Styrene
1, 1, 2, 2-Tetrachloroethane
Toluene
1, 2, 4-Trichlorobenzene
1, 1, 2-Trichloroethane
Trichloroethene (Trichloroethylene)
2, 2, 4 Trimethylpentane
Vinyl Chloride
Vinylidene Chloride (1, 1-Dichloroethene)
Xylenes (Dimethylbenzene)

Although the ToxWatch Study period has ended, OAQ continues to monitor toxics in the four urban areas and provide the data to the public via IDEM’s website. Subsequent to completion of the study, OAQ has modified the toxics monitoring program to include more pollutants and to provide easier public access to the data. Summary data from the ToxWatch Study are included in Appendix A.

The ToxWatch Study and OAQ’s continued monitoring efforts occur at a time when there is an increased national emphasis on assessing and reducing risks associated with exposure to toxic air pollutants. As the United States Environmental Protection Agency (US EPA), the states, and local communities work on this issue, toxic air pollutant monitoring stations are being established in many communities throughout the country to better assess ambient levels of toxic air pollutants. As time goes on, the availability of data from other areas will allow OAQ to compare toxic air pollutant levels in Indiana with other areas of the country.

Additionally, US EPA has focused significant attention and resources on addressing national and local air toxics issues. Several tools, such as air quality models and risk assessment guidance, have been or are under development to assist states and local communities in assessing and reducing risks. US EPA has also been working on national-level assessments to assist in identifying potential 'hot spots' or areas of concern that warrant additional local assessment.

Federal Air Toxics Studies

The US EPA has recently performed two national level air toxics assessments – the Cumulative Exposure Project (CEP) and the National Air Toxics Assessment (NATA). Both of these projects were used for comparison with monitoring data collected in the ToxWatch Study.

The first project was the Cumulative Exposure Project (CEP). This project modeled air toxics concentrations on a national-level using 1990 Toxic Release Inventory information. As part of this project, US EPA developed screening benchmarks for both cancer and noncancer health effects. The benchmark concentrations were based on standard toxicological references. The cancer benchmark represents a one in a million increased risk of cancer to a population exposed to that concentration of the pollutant 24 hours a day for 70 years. This means if one million people were exposed to a toxic air pollutant at more than the benchmark concentration for 70 years, then we would expect to find one more case of cancer than normally expected for a million people.

Neither benchmark is a standard enforceable by law. However, they provide useful comparison points that represent an estimated concentration of air toxics below which health impacts in an exposed population are not expected. Additional information regarding these benchmarks can be found at http://www.epa.gov/cumulativeexposure/CEPpapers/paperCWMA.pdf, see page 431.

The second project was US EPA's National Air Toxics Assessment (NATA). NATA also modeled air toxics concentrations on a national level. This assessment used 1996 Toxic Release Inventory information and was focused on a smaller set of 33 pollutants identified as urban air toxics. However, the assessment went one step further than the CEP by also providing an exposure assessment to evaluate potential public health risks.

Monitoring data collected in the ToxWatch Study were compared to the modeling projections in NATA to assess their accuracy and determine if the NATA model could be used as a tool to estimate levels of air toxics in Indiana where monitors do not exist. Information on the NATA project can be found at http://www.epa.gov/ttn/atw/nata/

Study Goals

The goals of IDEM's ToxWatch Study were to:

- determine levels of selected toxic air pollutants in four urban areas in Indiana;

- determine if the modeling projections used in federal air toxics studies could be used to accurately predict toxic air pollutant levels in areas where monitoring is not occurring; and

- determine whether levels of any of the monitored pollutants were of sufficient concern to require further assessment or action.

Technical Advisory Group

OAQ assembled an advisory group of scientists and technical experts from academia, environmental groups, and the business community to evaluate and provide input to ToxWatch data analysis and this report, and to participate in the longer-term policy discussions concerning the findings. This group met four times between June 2000 and June 2001.

SECTION 1.1 MONITORING STATION SELECTION

The ToxWatch Study established air toxics monitoring stations in four urban areas with the highest reported releases of toxic air pollutants according to US EPA's Toxics Release Inventory (TRI) – Elkhart County, Indianapolis (Marion County), Northwest Indiana (Lake and Porter Counties) and Evansville (Posey and Vanderburgh Counties). Additional information on the toxic releases in Indiana may be found at http://www.IN.gov/idem/oppta/tri/index.html

Two types of monitoring stations were established. A monitoring station was located in each area for the duration of the study. In addition, three (3) short-term (6-month) community monitoring stations were located in each community, on a rotating basis. Monitoring stations were located based on population and proximity to where children learn and play. In the case of Northwest Indiana, data collected by this study supplement longer-term data that have been collected in Hammond and Gary.

Figure 1 identifies the four monitoring areas. Figures 2 to 5 identify the locations of the two-year and community monitoring locations in each area.

Figure 1
Air Toxic Monitoring Stations
Toxwatch Study, 1999-2001

Figure 2

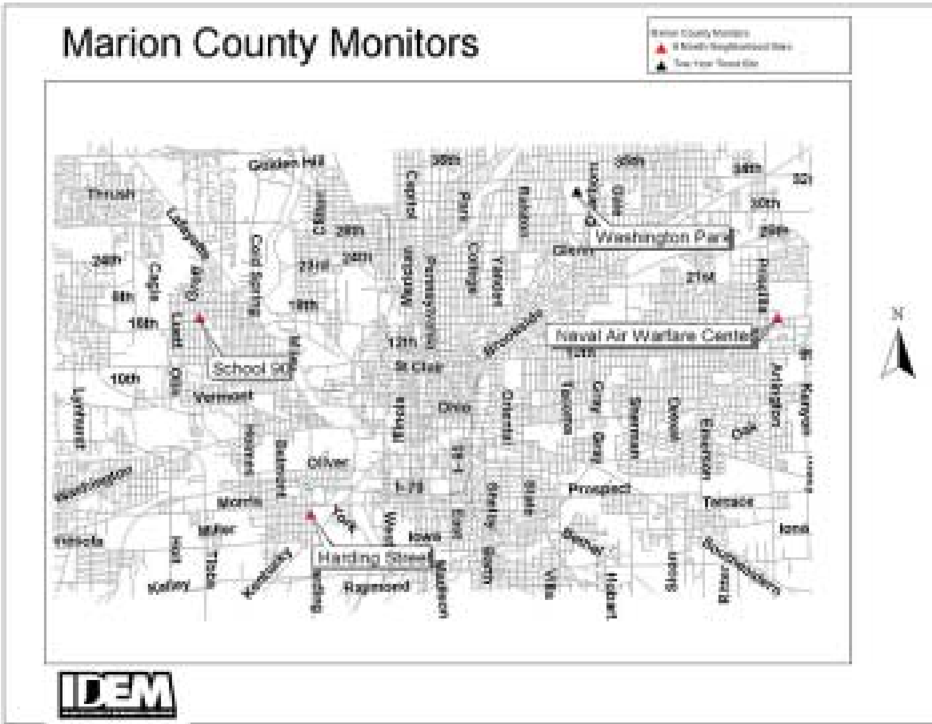


Figure 3

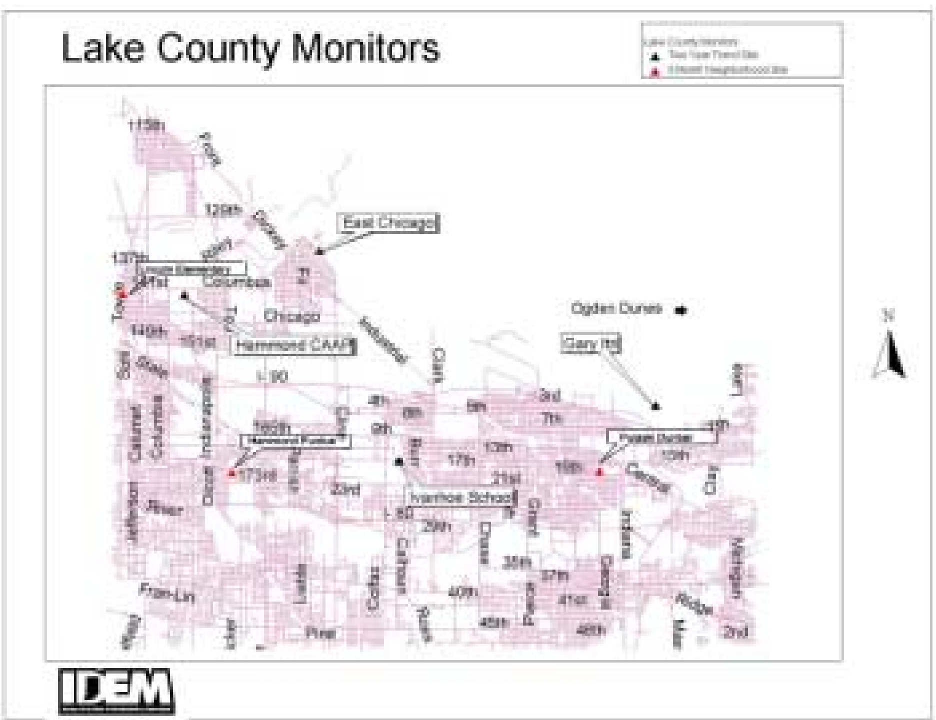


Figure 4

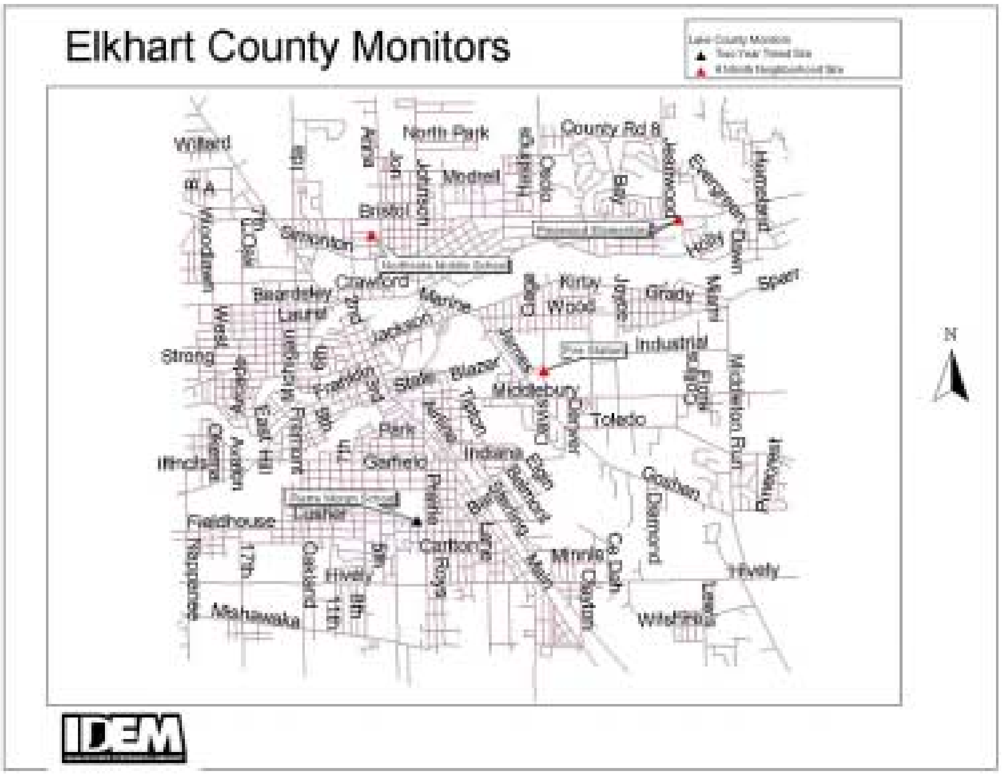
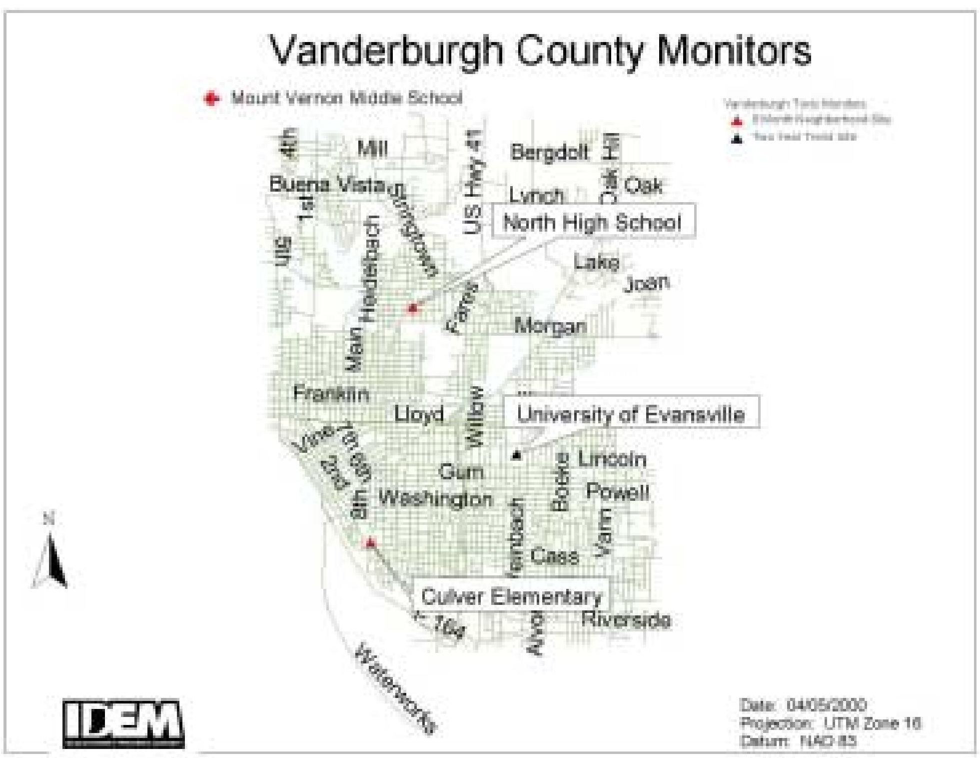


Figure 5



SECTION 1.2 DATA COLLECTION METHODOLOGY

The two-year monitoring stations began operation on June 1, 1999.[1] Ambient air samples were collected in six liter SUMMA polished canisters that were cleaned, certified, and evacuated prior to sampling. Samples were collected using the US EPA one-in-six day "National Sampling Schedule." The national sampling schedule is used as standard for collecting data from different areas around the country. The sampling occurred over a twenty-four hour period. OAQ's Air Toxics monitoring staff collected and analyzed each sample at OAQ's Indianapolis laboratory.

When samples arrived at the lab for analysis, they were logged for tracking and record keeping purposes. The initial and final sample pressures were recorded to meet sample validity criteria established according to OAQ standard operating procedures. Each sample was processed to analyze for total nonmethane organic compounds (US EPA Method TO-12), ozone precursors compounds (US EPA Method TO-17, Perkin Elmer Autosystem GC), and hazardous air pollutants (HAPs) (US EPA Method TO-14A, HP GC/MS system).

Samples were analyzed for total non-methane organic compounds using US EPA Method TO-12 to determine the concentration of total volatile organic compounds (VOCs). This analytical system consists of a Hewlett Packard model 6890 gas chromatograph with a manual cryogenic pre-concentrating system. The system uses a single Flame Ionization Detector (FID) to detect organic compounds in the samples. This analysis is required by US EPA, and has the added benefit of aiding the analyst in determining the appropriate amount of sample to analyze on the more sensitive GC/MS and Perkin Elmer instruments.

Samples were analyzed for fifty-six organic compounds, which are classified as ozone precursors. These compounds combine with oxides of nitrogen and ultraviolet rays from the sun to form ground level ozone during summer months when ambient conditions are hot and humid. Ozone in the breathable layer of the atmosphere can have adverse effects on human health. Samples were analyzed using a Perkin Elmer AutoGC system equipped with a canister rack system (US EPA method TO-17). The system was calibrated using US EPA's reference standard provided to all states. The detection limits of the system are in the sub parts per billion range.

Samples also were analyzed for thirty hazardous air pollutants using a GC/MS system comprised of Hewlett Packard Gas Chromatograph, model 5890 and mass selective detector model 5971A interfaced with a Tekmar Auto Can system (US EPA method TO-14). The system was calibrated using the thirty-nine component standard obtained from the Spectra Gases. The system is very sensitive to moisture in the samples. The Auto Can pre-concentrating system is designed to remove water from the sample without removing water soluble organic compounds, which makes this system unique. All data were transferred to the Oracle toxic database for archiving and posting to the ToxWatch website.

[1]Although this study ended in June, sampling at the two-year trend sites continues. Data from the ToxWatch study as well as additional data collected after June 2001 can be found on the OAQ website at http://www.state.in.us/idem/oam/toxwatch/index.htm.

SECTION 1.3 QUALITY ASSURANCE

All samples were analyzed using OAQ's Standard Operating Procedures (SOP) established for each instrument. Quality assurance and quality control procedures were also followed for the sampling and analysis. The method detection limits for all analytical systems were established for all three systems according to the procedure outlined in the Federal Register 40 CFR, part 136, Subpart B.

Continuing calibration responses were plotted for each instrument using a control chart with +/- 10% upper and lower bounds to verify that each instrument remained properly calibrated throughout the ToxWatch Study. Instruments were re-calibrated any time the continuing calibration parameters fell outside of the bounds of the control chart. All data from this study are submitted to the US EPA Aerometric Information Retrieval System (AIRS) database so that the data are available for assessment by others.

SECTION 1.4 DATA ANALYSIS

After data were collected, analyzed, and quality assured, the percentage of valid samples was calculated. A review of other state air toxic studies revealed that most eliminated data from monitoring stations with less than seventy-five percent valid data. This method of screening the data is consistent with the intermittent sampling methodology described in 40 CFR 50 regarding National Primary and Secondary Standards. Less than seventy-five percent valid data were collected at five monitoring stations included in the ToxWatch study. These monitoring stations included two (2) two-year stations – Gary IITRI and East Chicago, both in Lake County – and three (3) six-month stations – Naval Air Warfare Center and School 90 in Marion County, and Lincoln Elementary in Lake County. While presented for informational purposes throughout this report, these data were not included in the analysis.

In addition, for <u>detectable</u> samples with concentrations less than the Method Detection Limit (MDL), the concentrations are reported as ½ of the MDL. <u>Non-detect</u> samples were not used to calculate the mean monitored concentration. This method of analyzing data below the MDL is described in US EPA's "Technical Assistance Document for Sampling and Analysis of Ozone Precursors, Section 2.6.2 Airs AQS Data Submittal, and July 1997." The mean monitored concentration was calculated for each pollutant and used in the three analyses discussed below.

<u>Analysis 1: CEP Benchmark Comparison</u>

The mean concentration for each monitored pollutant was compared to US EPA's CEP benchmarks for both cancer and non-cancer health effects.[2] US EPA CEP benchmarks were used because they represent levels below which health effects are not expected.

This comparison was performed to assess possible concerns based on ambient levels of individual toxic air pollutants.

Monitored pollutants that exceed the CEP benchmark are separated into two categories, high and low confidence, based on the relative level of uncertainty. The more data available for a pollutant, the higher the level of confidence that the monitored values are

[2] US EPA's CEP benchmarks are included in Appendix A.

accurate, particularly when calculating a mean monitored concentration. The level of confidence is based on the percentage of non-detect or zero values measured over the monitoring period for that particular pollutant. The higher this percentage, the lower the level of confidence in the data set as a whole. High confidence pollutants are those that have more than 50% detection with a mean monitored concentration above the CEP benchmark. Low confidence pollutants are those with less than 50% detection with a mean concentration above the CEP benchmark. It is more reasonable to try to draw conclusions from the higher confidence pollutants than the lower confidence pollutants.

Raw data from the ToxWatch Study are available at:
http://www.state.in.us/idem/air/toxwatch/index.html

Tables 1 and 2, under Part II. Findings, list pollutants with a mean concentration above a CEP benchmark, by level of confidence for each two-year monitoring station.

Analysis 2: Relative Hazard Values

After identifying possible concerns based on ambient levels of individual pollutants, this analysis attempted to assess whether levels of monitored toxic air pollutants presented a concern either in aggregate or by geographic region.

To accomplish this analysis, a relative hazard value was calculated for each monitored pollutant. For this study, the relative hazard value is the ratio of the

$$\frac{\text{Pollutant (mean monitored concentration)}}{\text{CEP benchmark}}$$

For example, if the mean concentration of pollutant "A" is 0.87 part-per-billion (ppb) and its cancer benchmark is 0.70 ppb, then the relative hazard value is 0.87/0.70 or 1.24.

The relative hazard values for all toxic air pollutants monitored at each two-year monitoring station were then summed to provide an aggregate relative hazard value for comparison with other monitoring stations. This approach is similar to that used by Argonne National Laboratories in the draft US EPA Chicago Risk Initiative.

An aggregate relative hazard value was not calculated for the short-term (six-month) community monitoring stations due to data limitations and possible seasonal variability.

Table 4, under Part II. Findings, lists the aggregate relative hazard values for both cancer and noncancer health effects for each two-year monitoring station.

Analysis 3: NATA Comparison

Air quality modeling is often used to predict probable levels of air pollution where air monitoring data are not available and to assess the impacts of potential emission reduction strategies. US EPA projected ambient concentrations using an air dispersion model as part of the National Air Toxics Assessment. The final data analysis was an assessment of the accuracy of the NATA modeled values by comparing them to actual monitored values.

Tables 5 through 8, under II. Findings, summarize this comparison.

SECTION 1.5 STUDY LIMITATIONS

The following are limitations of the ToxWatch Study:

- The study compares mean monitored concentrations to US EPA CEP benchmarks for both cancer and non-cancer health effects. These benchmarks are not "bright lines' between pollutant concentrations with and without effects but rather were used because they represent levels below which health effects are not expected.

  These benchmarks were used for comparative purposes only and do not indicate specific risks associated with exposure to monitored toxic air pollutants. Additionally, the benchmarks assume continuous exposure over a seventy-year period to the specific compound while the sampling methodology is based on intermittent samples collected over a very short period (6 months to 2 years). The benchmarks include a built in margin of safety that may be too conservative or may not be adequate to protect sensitive populations. Finally, in some cases, US EPA's calculated CEP benchmarks are below the detection levels of the analytical methods used in the ToxWatch study.

- Use of the aggregate relative hazard values to draw conclusions is limited by uncertainties including the appropriateness of the underlying benchmarks. In addition, as a simple summation of the relative hazard values for individual monitored pollutants, they do not address possible synergistic effects resulting from exposure to multiple pollutants.

- The Study did not include an exposure assessment. Therefore, the contents of this report should not be construed to imply or represent any specific findings with respect to risks associated with exposure to the monitored pollutants.

- This Study only evaluates ambient air concentrations of a limited number of pollutants and does not account for indoor exposure, other routes of exposure such as ingestion, or cumulative exposure to multiple pollutants.

- This Study did not attempt to assess health data or make any linkages between disease incidences and environmental data.

- Several toxic air pollutants of interest nationally were not monitored in the study, including formaldehyde, metals, and diesel particulate. Recent studies suggest that these pollutants may cause significant health effects, especially in sensitive populations.

- The use of mean monitored concentrations in the analysis may not be representative of actual conditions at any given point in time.

- Other data uncertainties exist including whether data collected on an intermittent sampling schedule are representative of typical air quality, sensitivity of the sampling instruments, possible seasonal variability, meteorology, the number of invalid samples at some monitoring stations, especially the six-month community monitoring stations.

- Comparisons of the ToxWatch data to US EPA's NATA must be made with caution because the studies use different assumptions and base years. The ToxWatch data are summarized as mean monitored concentrations over a time period, either six-months or two years. These data were collected from 1999 through 2001. US EPA's NATA was based on modeled pollutant concentrations using 1996 TRI data. When comparing these data sets, two important points need to be made. First, several new federal emission standards targeting sources of toxic air pollutants were implemented during the period between 1996 and 2001. Therefore, the emissions information used in the model may be outdated, making the model projections unreliable. Second, there is limited overlap in pollutants monitored in the ToxWatch Study and those modeled as part of US EPA's NATA. In some cases, the model projections are below the detection levels of the analytical methods used in the ToxWatch Study.

PART II FINDINGS

SECTION 2.1 CEP BENCHMARK COMPARISON

Caution – The reader is encouraged to review the limitations of this study as described in Section 1.5 before reading the findings under this section.

The mean concentration of each monitored pollutant was compared to US EPA's CEP benchmarks for both cancer and non-cancer health effects to assess possible concerns based on ambient levels of individual compounds. As explained in Section 1.4, pollutants with a mean concentration (over the monitoring period) that exceeds the CEP benchmark are separated into two categories, high and low confidence, based on the relative level of uncertainty.

Table 1 presents the results of this comparison for each two-year monitoring station while Table 2 presents the results for each six-month community monitoring station. The tables list pollutants that exceed the CEP benchmark for cancer by level of confidence – high or low. The percentage of valid data return at each monitoring station is also included in each table.

Results for the comparison to noncancer benchmarks are not included in this report since no monitored pollutant exceeded its respective CEP noncancer benchmark.

TABLE 1: Two-Year Monitoring Stations – Toxic Air Pollutants That Exceeded US EPA’s CEP Benchmark for Cancer

Pierre Moran School (81% VDR)	**University of Evansville (86% VDR)**	**Washington Park (96% VDR)**	**Gary Ivanhoe (79% VDR)**
Elkhart County	Vanderburgh County	Marion County	Lake County
High Confidence	**High Confidence**	**High Confidence**	**High Confidence**
Benzene	Benzene	Benzene	Benzene
Carbon tetrachloride	Carbon tetrachloride	Carbon tetrachloride	Carbon tetrachloride
Chloromethane	Chloroform	Chloroform	Chloroform
P-dichlorobenzene	Chloromethane	Chloromethane	Chloromethane
Styrene	P-dichlorobenzene	P-dichlorobenzene	P-dichlorobenzene
Trichloroethene		Trichloroethene	
Low Confidence	**Low Confidence**	**Low Confidence**	**Low Confidence**
Chloroform	1,2-dichloroethane	1,2-dichloroethane	1,2-dichloroethane
1,2-dichloroethane	Vinyl chloride	1,2-dichloropropane	1,2-dichloropropane
1,2-dichloropropane	Vinylidene chloride	Vinyl chloride	Vinyl chloride
Hexachloro-1,3-butadiene		Vinylidene chloride	
1,1,2,2-tetrachloroethane			
Vinyl chloride			
Vinylidene chloride			

Ogden Dunes (91% VDR)	***East Chicago (58% VDR)****	***Gary IITRI (74% VDR)****	**Hammond CAAP (78% VDR)**
Porter County	*Lake County*	*Lake County*	Lake County
High Confidence	**High Confidence**	**High Confidence**	**High Confidence**
Benzene	*Benzene*	*Benzene*	Benzene
Carbon tetrachloride	*Carbon tetrachloride*	*Carbon tetrachloride*	Carbon tetrachloride
Chloromethane	*Chloroform*	*Chloroform*	Chloromethane
P-dichlorobenzene	*Chloromethane*	*Chloromethane*	
Trichloroethene	*P-dichlorobenzene*		
	Trichloroethene		
Low Confidence	**Low Confidence**	**Low Confidence**	**Low Confidence**
Chloroform	*1,2-dichloroethane*	*P-dichlorobenzene*	Chloroform
1,2-dichloroethane	*1,2-dichloropropane*	*1,2-dichloroethane*	P-dichlorobenzene
1,2-dichloropropane	*C-1,3-dichloropropene*	*1,2-dichloropropane*	1,2-dichloroethane
T-1,3-dichloropropene	*T-1,3-dichloropropene*	*T-1,3-dichloropropene*	1,2-dichloropropane
Hexachloro-1,3-butadiene	*1,1,2,2-tetrachloroethane*	*Hexachloro-1,3-butadiene*	C-1,3-dichloropropene
1,1,2,2-tetrachloroethane	*1,1,2-trichloroethane*	*1,1,2,2-tetrachloroethane*	T-1,3-dichloropropene
1,1,2-trichloroethane	*Vinyl chloride*	*1,1,2-trichloroethane*	Hexachloro-1,3-butadiene
Vinyl chloride	*Vinylidene chloride*	*Vinyl chloride*	1,1,2,2-tetrachloroethane
Vinylidene chloride		*Vinylidene chloride*	1,1,2-trichloroethane
			Vinyl chloride
			Vinylidene chloride

** The East Chicago and Gary IITRI monitoring stations had less than 75% valid data return and are presented for informational purposes only.*

TABLE 2: Six-Month Community Monitoring Stations – Toxic Air Pollutants That Exceeded US EPA's CEP Benchmark for Cancer

Pinewood School (92% VDR)	**Northside Middle School (82% VDR)**	**Elkhart Firestation (84% VDR)**
Elkhart County	Elkhart County	Elkhart County
7/29/99 – 2/24/00	8/22/99 – 2/24/00	7/17/99 – 2/24/00
High Confidence	**High Confidence**	**High Confidence**
Benzene	Benzene	Benzene
Carbon Tetrachloride	Carbon tetrachloride	Carbon tetrachloride
Chloromethane	Chloromethane	Chloromethane
Dichloromethane	Dichloromethane	Dichloromethane
Trichloroethene		P-dichlorobenzene
		Styrene
Low Confidence	**Low Confidence**	**Low Confidence**
Chloroform	Chloroform	Chloroform
P-dichlorobenzene	P-dichlorobenzene	1,2-dichloroethane
1,2-dichloroethane	1,2-dichloroethane	1,2-dichloropropane
1,2-dichloropropane	1,2-dichloropropane	Vinyl chloride
vinyl chloride	Hexachloro-1,3-butadiene	
Vinylidene chloride	Vinyl chloride	

Culver Elementary School (94% VDR)	**North High School (88% VDR)**	**Mount Vernon Middle School (85% VDR)**
Vanderburgh County	Vanderburgh County	Posey County
1/19/00-7/29/00	1/19/00-7/29/00	1/19/00-7/23/00
High Confidence	**High Confidence**	**High Confidence**
Benzene	Benzene	Benzene
Carbon tetrachloride	Carbon tetrachloride	Carbon tetrachloride
Chloroform	Chloroform	Chloroform
Chloromethane	Chloromethane	Chloromethane
P-dichlorobenzene	P-dichlorobenzene	P-dichlorobenzene
1,2-dichloroethane	1,2-dichloroethane	1,2-dichloroethane
	Styrene	Trichloroethene
		Vinylidene chloride
Low Confidence	**Low Confidence**	**Low Confidence**
Vinylidene chloride	Vinylidene chloride	NA

*Naval Air Warfare Center (64% VDR)**	**Harding Street (83% VDR)**	***School 90 (60% VDR)****
Marion County	Marion County	*Marion County*
3/13/99-11/26/99	4/24/99-11/26/99	*6/5/99-11/26/99*
High Confidence	**High Confidence**	***High Confidence***
Benzene	Benzene	*Benzene*
Carbon tetrachloride	Carbon tetrachloride	*Carbon tetrachloride*
Chloromethane	Chloromethane	*Chloromethane*
P-dichlorobenzene	Trichloroethene	*P-dichlorobenzene*
Trichloroethene	Vinyl chloride	*Styrene*
Vinyl chloride		*Vinyl chloride*
Low Confidence	**Low Confidence**	***Low Confidence***
Chloroform	Chloroform	*Chloroform*
1,1-dichloroethane	P-dichlorobenzene	*1,2-dichloropropane*
1,2-dichloropropane	1,2-dichloropropane	*Trichloroethene*
Vinylidene chloride	Vinylidene chloride	

Lincoln Elementary (67% VDR)*	**Pulaski Dunbar (86% VDR)**	**Hammond Purdue (82% VDR)**
Lake County	Lake County	Lake County
8/16/00-3/26/01	7/23/00-4/1/01	7/5/00-4/1/01
High Confidence	**High Confidence**	**High Confidence**
Benzene	Benzene	Benzene
Carbon tetrachloride	Carbon tetrachloride	Carbon tetrachloride
Chloromethane	Chloroform	Chloroform
P-dichlorobenzene	Chloromethane	Chloromethane
	P-dichlorobenzene	P-dichlorobenzene
	Ethylbenzene	1,1,2-trichloroethane
	1,1,2-trichloroethane	Vinylidene chloride
	Styrene	
Low Confidence	**Low Confidence**	**Low Confidence**
Chloroform	1,1,2,2-tetrachloroethane	Vinyl chloride
1,2-dichloroethane	Vinyl chloride	
1,1,2,2-tetrachloroethane	Vinylidene chloride	

****The Naval Air Warfare Center, School 90 and Lincoln Elementary monitoring stations had less than 75% valid data return and are presented for informational purposes only.***

Table 3a. lists ‘high confidence’ toxic air pollutants that exceeded the US EPA CEP cancer benchmarks at one or more two-year monitoring stations. Table 3b. lists ‘high confidence’ toxic air pollutants that exceeded the US EPA CEP cancer benchmarks at one or more two-year monitoring stations. Results for the comparison to noncancer benchmarks are not included in this report since no monitored pollutant exceeded its respective CEP noncancer benchmark.

Table 3a. Toxic Air Pollutants That Exceeded the US EPA CEP Cancer Benchmarks, With A High level Of Confidence, At One or More Two-Year Monitoring Stations

County	Lake				Porter	Marion	Elkhart	Vanderburgh
Monitoring Station	**Gary Ivanhoe**	**East Chicago***	**Gary IITRI***	**Hammond CAAP**	**Ogden Dunes**	**Washington Park**	**Pierre Moran**	**University of Evansville**
Benzene	X	X	X	X	X	X	X	X
Carbon tetrachloride	X	X	X	X	X	X	X	X
Chloromethane	X	X	X	X	X	X	X	X
Chloroform	X	X	X			X		X
p-dichlorobenzene	X	X			X	X	X	X
Styrene							X	
Trichloroethene		X			X	X	X	

**** The East Chicago and Gary IITRI monitoring stations had less than 75% valid data return and are presented for informational purposes only.***

Table 3b. Toxic Air Pollutants That Exceeded the US EPA CEP Cancer Benchmarks, With A High level Of Confidence, At One or More Six-Month Community Monitoring Stations

County	Elkhart			
Compound	**Monitoring Station**			
	Pierre Moran	**Pinwood School**	**Northside Middle School**	**Elkhart Firestation**
Benzene	X	X	X	X
Carbon tetrachloride	X	X	X	X
Chloromethane	X	X	X	X
Chloroform				
p-dichlorobenzene	X			X
1,2-dichloroethane				
Dichloromethane		X	X	X
Ethylbenzene				
Styrene	X			X
1,1,2-trichloroethane				
Trichloroethene	X	X		
Vinyl chloride				
Vinylidene chloride				

County	Vanderburgh and Posey			
Compound	Monitoring Station			
	University of Evansville	Culver Elementary School	North High School	Mount Vernon Middle School (Posey)
Benzene	X	X	X	X
Carbon tetrachloride	X	X	X	X
Chloromethane	X	X	X	X
Chloroform	X	X	X	X
p-dichlorobenzene	X	X	X	X
1,2-dichloroethane		X	X	X
Dichloromethane				
Ethylbenzene				
Styrene			X	
1,1,2-trichloroethane				
Trichloroethene				X
Vinyl chloride				
Vinylidene chloride				X

County	Marion			
Compound	Monitoring Station			
	Washington Park	Naval Air Warfare Center*	Harding Street	School 90*
Benzene	X	X	X	X
Carbon tetrachloride	X	X	X	X
Chloromethane	X	X	X	X
Chloroform	X			
p-dichlorobenzene	X	X		X
1,2-dichloroethane				
Dichloromethane				
Ethylbenzene				
Styrene				X
1,1,2-trichloroethane				
Trichloroethene		X	X	
Vinyl chloride		X	X	X
Vinylidene chloride				

***** *The Naval Air Warfare Center and School 90 monitoring stations had less than 75% valid data return and are presented for informational purposes only.*

County	Lake and Porter							
Compound	Monitoring Station							
	Gary Ivanhoe	East Chicago*	Gary IITRI*	Hammond CAAP	Ogden Dunes	Lincoln Elem.*	Pulaski Dunbar	Hammond Purdue
Benzene	X	X	X	X	X	X	X	
Carbon tetrachloride	X	X	X	X	X	X	X	
Chloromethane	X	X	X	X	X	X	X	
Chloroform	X	X	X				X	
p-dichlorobenzene	X	X			X	X	X	
1,2-dichloroethane								
Dichloromethane								
Ethylbenzene							X	
Styrene	X						X	
1,1,2-trichlorethane							X	
Trichloroethene		X			X			
Vinyl chloride								
Vinylidene chloride								

***** *The East Chicago, Gary IITRI and Lincoln Elementary monitoring stations had less than 75% valid data return and are presented for informational purposes only.*

Summary

Three toxic air pollutants – benzene, carbon tetrachloride, and chloromethane – were found at all monitoring stations at mean concentrations exceeding US EPA's CEP cancer benchmark. Several other toxic air pollutants exceeded US EPA's CEP cancer benchmark at one or more monitoring stations. These pollutants included p-dichlorobenzene, chloroform, trichloroethene and styrene.

These findings are consistent with US EPA's analysis as part of the CEP. That analysis indicated that, due to elevated background concentrations, seven (7) pollutants exceeded the CEP benchmarks all across the country. These seven pollutants included four (4) pollutants that had high mean concentrations in Indiana – benzene, carbon tetrachloride, chloroform and chloromethane.

While the toxic air pollutants exceeding the CEP benchmarks were detected at most monitoring locations, there are clearly some localized influences. For example, the highest styrene levels were measured in Elkhart where there is a significant number of fiberglass and plastics manufacturers.

One important assumption was made when comparing the monitored concentrations to US EPA's CEP benchmarks. In instances when the toxic air pollutant was not detected, OAQ assumed the concentration to be ½ of the analytical method's minimum detection level. This was purposely done to provide a conservative screen for pollutants of possible concern. Further investigation is necessary to determine whether the identified pollutants present a public health concern.

SECTION 2.2 RELATIVE HAZARD VALUES

Caution – The reader is encouraged to review the limitations of this study as described in Section 1.5 before reading the findings under this section.

As explained in Section 1.4, this analysis attempted to assess whether levels of monitored toxic air pollutants presented a concern either in aggregate or by geographic region.

To accomplish this, a relative hazard value was calculated for each monitored pollutant. For this study, the relative hazard value is the ratio of the

$$\frac{\text{Pollutant (mean monitored concentration)}}{\text{CEP benchmark}}$$

For example, if the mean concentration of pollutant "A" is 0.87 ppb and its cancer benchmark is 0.70 ppb, then the relative hazard value is 0.87/0.70 or 1.24.

The relative hazard values for all toxic air pollutants monitored at each two-year monitoring station were then summed to provide an aggregate relative hazard value for comparison with other monitoring stations. This approach is similar to that used by Argonne National Laboratories in the draft US EPA Chicago Risk Initiative.

An aggregate relative hazard value was not calculated for the short-term (six-month) community monitoring stations due to data limitations and possible seasonal variability.

Table 4 lists the aggregate relative hazard values for both cancer and noncancer health effects for each two-year monitoring station.

TABLE 4: Aggregate Relative Hazard Values For Two-Year Monitoring Stations

Monitoring Location	Hazard (Cancer)	Hazard (non-cancer)*
*East Chicago, Lake**	*152.60*	*0.66*
Pierre Moran School, Elkhart	150.22	0.54
Hammond CAAP, Lake	149.80	0.52
Washington Park, Marion	130.75	0.54
*Gary IITRI, Lake**	*130.06*	*0.42*
Ogden Dunes, Porter	116.03	0.41
Gary Ivanhoe, Lake	107.34	0.46
University of Evansville, Vanderburgh	59.83	0.65

**** The East Chicago and Gary IITRI monitoring stations had less than 75% valid data return and are presented for informational purposes only**.*

Summary

The aggregate relative hazard values indicated that the relative hazard for most of the study areas was comparable with the exception of Evansville, which had a significantly lower aggregate value. Again it is important to remind the reader to refer to Section 1.5 discussing the limitations of this study and to recognize that the two-year study period is relatively brief and subject to uncertainties.

SECTION 2.3 COMPARING NATA MODELED VALUES TO AIR QUALITY MONITORING DATA

Caution – The reader is encouraged to review the limitations of this study as described in Section 1.5 before reading the findings under this section.

Air quality modeling is often used to predict probable levels of air pollution where air monitoring data are not available and to assess the impacts of potential emission reduction strategies. US EPA projected ambient concentrations of 33 air toxics using an air dispersion model as part of the National Air Toxics Assessment. The final data analysis was an assessment of the accuracy of the NATA modeled values by comparing them to actual monitored values.

Comparing the NATA modeled values with actual air quality monitoring data is complicated by several factors. First, the two studies have only 12 pollutants in common. Further, since ToxWatch focused on organic pollutants, none of the common pollutants were metals.

Second, in several instances, NATA modeled values are lower than the minimum detectable levels for the monitored compounds.

Third, there are inherent differences in the methodologies employed in each study. The monitoring data were collected on an intermittent basis as a 24-hour composite sample. The NATA modeled values are projected mean concentrations of pollutants on an annual basis. These values represent concentrations averaged over a given census tract, and presented as a county level range in this study, while the monitoring stations represent just one point within the area covered by the modeling projections. Therefore, the monitoring data may not be representative of the modeled area.

Additionally, the NATA model values include assumptions that may not be accurate. For example, the modeling results rely on emissions information, which may or may not be accurate. This could cause this model to over- or under-predict ambient air toxics concentrations. This is especially a concern for metals, which were not evaluated as part of this study. Further, as explained in Section 1.5. Limitations, the monitoring data were collected from 1999 through 2001. US EPA's NATA was based on 1996 Toxics Release Inventory data. Several new federal emission standards targeting sources of air toxics were implemented during the period between 1996 and 2001. Therefore, the emissions information used in the model may be outdated, making the model projections unreliable.

Finally, US EPA's NATA assumed the background levels of some pollutants to be above the respective CEP benchmark. This assumption may not be accurate. However, it does affect the risk profile of these pollutants. This issue is further complicated by the fact that some of the background levels are below current analytical method detection level making verification of the background assumptions difficult.

Tables 5 through 8 summarize the comparison of the mean monitored values with the NATA projections, as a range, across all census tracts within the county or counties where the monitoring stations are located.

TABLE 5: 1996 NATA Estimation Comparison to 1999-2001 Monitoring Data for Elkhart County

Pollutant	MDL (ppb)	CAS#	1996 NATA – Range of Estimated Annual Mean Ambient Concentration Across all Elkhart County Census Tracts (ppb)	Pierre Moran School May 18, 1999 to July 12, 2001 Mean (ppb)	Northside Middle School Aug 22, 1999 to Feb 24, 2000 Mean (ppb)	Pinewood School July 29, 1999 to Feb 24, 2000 Mean (ppb)	Elkhart FireStation July 17, 1999 to Feb 24, 2000 Mean (ppb)
Benzene	0.08	71432	0.287 – 0.544	**0.42**	**0.37**	**0.28**	**0.45**
Carbon Tetrachloride	0.12	56235	0 .140 – 0.140	0.06	0.06	0.06	0.06
Chloroform	0.19	67663	0.017 – 0.018	0.10	0.10	0.10	0.10
1,3-Dichloropropene	cis 0.28	542756	0.003 – 0.024	0.14	ND*	ND*	ND*
1,3-Dichloropropene	trans 0.18			0.09	ND	0.09	ND*
Ethylene Dibromide (1,2-dibromoethane)	0.12	106934	0.001 – 0.001	ND*	ND*	ND*	ND*
Ethylene Dichloride (1,2-dichloroethane)	0.08	107062	0.015 – 0.015	0.06	0.04	0.04	0.04
Methylene Chloride (dichloromethane)	0.10	75092	0.159 – 2.259	**0.51**	**0.68**	**1.92**	**1.61**
Perchloroethylene (tetrachloroethene)	0.12	127184	0.027 – 0.053	0.06	0.06	0.06	0.06
Propylene Dichloride (1,2-dichloropropane)	0.15	78875	0.0000 – 0.0000	0.16	0.08	0.13	0.18
1,1,2,2-Tetrachloroethane	0.07	79345	0.0000 – 0.0000	0.04	ND*	ND*	ND*
Trichloroethylene	0.16	79016	0.025 – 0.051	0.11	0.10	0.11	0.10
Vinyl Chloride	0.22	75014	0.0000 – 0.0001	0.11	0.11	0.11	0.11

*** Bolded numbers reflect mean monitored values that fall with the range predicted in US EPA's NATA; ND = not detected**

TABLE 6: 1996 NATA Estimation Comparison to 1999-2001 Monitoring Data for Vanderburgh and Posey Counties

Pollutant	MDL (ppb)	CAS#	1996 NATA - Range of Estimated Annual Mean Ambient Concentration Across all Vanderburgh County Census Tracts (ppb)	1996 NATA - Range of Estimated Annual Mean Ambient Concentration Across all Posey County Census Tracts (ppb)	University of Evansville Jun 23, 1999 to June 30, 2001 Mean (ppb)	North High School Jan 19, 2000 to Jul 29, 2000 Mean (ppb)	Culver School Jan 19, 2000 to Jul 29, 2000 Mean (ppb)	Mount Vernon School Jan 19, 2000 to Jul 23, 2000 Mean (ppb)
Benzene	0.08	71432	0.299 - 0.647	0.205 - 0.491	**0.40**	**0.41**	**0.26**	**0.18**
Carbon Tetrachloride	0.12	56235	0.140 - 0.140	0.140 - 0.140	0.06	0.06	0.06	0.07
Chloroform	0.19	67663	0.017 - 0.018	0.017 - 0.017	0.10	0.10	0.10	0.1
1,3-Dichloropropene	cis 0.28	542756	0.003 - 0.030	0.001 - 0.008	0.14	0.14	0.14	ND*
1,3-Dichloropropene	trans 0.18				0.09	0.09	0.09	ND*
Ethylene Dibromide (1,2-dibromoethane)	0.12	106934	0.001 - 0.001	0.001 - 0.001	ND*	0.06	ND*	ND*
Ethylene Dichloride (1,2-dichloroethane)	0.08	107062	0.015 - 0.015	0.015 - 0.015	0.04	0.04	0.04	0.04
Methylene Chloride (dichloromethane)	0.10	75092	0.059 - 0.171	0.048 - 0.079	0.12	0.42	0.15	0.09
Perchloroethylene (tetrachloroethene)	0.12	127184	0.029 - 0.082	0.022 - 0.027	0.06	0.06	0.06	0.06
Propylene Dichloride (1,2-dichloropropane)	0.15	78875	0.0000 - 0.0000	0.0000 - 0.0000	0.24	ND*	ND*	ND*
1,1,2,2-Tetrachloroethane	0.07	79345	0.0000 - 0.0000	0.0000 - 0.0000	0.04	0.04	0.04	ND*
Trichloroethylene	0.16	79016	0.021 - 0.074	0.020 - 0.024	0.09	0.08	0.08	0.11
Vinyl Chloride	0.22	75014	0.0001 - 0.0008	0.0005 - 0.032	0.11	0.11	ND*	0.15

*** Bolded numbers reflect mean monitored values that fall with the range predicted in US EPA's NATA; ND = not detected**

TABLE 7: 1996 NATA Estimation Comparison to 1999-2001 Monitoring Data for Marion County

Pollutant	MDL (ppb)	CAS#	1996 NATA - Range of Estimated Annual Mean Ambient Concentration Across all Marion County Census Tracts (ppb)	Washington Park (ppb) Apr 6, 1999-July 6, 2001 Mean (ppb)	*School 90 (ppb) June 5-Nov 26, 1999*** Mean (ppb)	*Naval ~~Avionics~~ Air Warfare Center (ppb) Mar 13-Nov 26, 1999*** Mean (ppb)	Harding Street (ppb) Apr 6-Nov 26, 1999 Mean (ppb)
Benzene	0.08	71432	0.499 - 0.820	**0.55**	***0.87***	*0.46*	**0.50**
Carbon Tetrachloride	0.12	56235	0.140 - 0.140	0.07	*0.06*	*0.06*	0.06
Chloroform	0.19	67663	0.017 - 0.018	0.10	*0.10*	*0.10*	0.10
1,3-Dichloropropene	Cis 0.28	542756	0.011 - 0.032	ND	*ND*	*ND*	ND
1,3-Dichloropropene	Trans 0.18			0.09	*ND*	*0.09*	0.09
Ethylene Dibromide (1,2-dibromoethane)	0.12	106934	0.001 - 0.001	ND*	*ND**	*ND**	0.06
Ethylene Dichloride (1,2-dichloroethane)	0.08	107062	0.015 - 0.015	0.04	*0.04*	*0.04*	0.04
Methylene Chloride (dichloromethane)	0.10	75092	0.094 - 0.254	**0.17**	***0.14***	*0.06*	0.27
Perchloroethylene (tetrachloroethene)	0.12	127184	0.040 - 0.083	**0.06**	*0.15*	***0.06***	**0.07**
Propylene Dichloride (1,2-dichloropropane)	0.15	78875	0.0000 - 0.0000	0.14	*0.13*	*0.16*	0.11
1,1,2,2-Tetrachloroethane	0.07	79345	0.0000 - 0.0000	0.04	*ND**	*ND**	ND*
Trichloroethylene	0.16	79016	0.022 - 0.064	0.14	*0.18*	*0.24*	0.24
Vinyl Chloride	0.22	75014	0.0000 - 0.0001	0.11	*0.11*	*0.13*	0.11

*** Bolded numbers reflect mean monitored values that fall with the range predicted in US EPA's NATA; ND = not detected;**

TABLE 8: 1996 NATA Estimation Comparison to 1999-2001 Monitoring Data for Lake and Porter Counties

Pollutant	MDL (ppb)	CAS#	1996 NATA - Range of Estimated Annual Mean Ambient Concentration Across all Lake County Census Tracts (ppb)	Ivanhoe School Jun 5, 1999 to July 12, 2001 Mean (ppb)	Hammond-Purdue Jul 1, 2000 to Mar 29, 2001 Mean (ppb)	Pulaski Dunbar Middle School Jul 20, 2000 to Mar 29, 2001 Mean (ppb)	*Lincoln Elementary School Jul 1, 2000 to Mar 29, 2001*** *Mean (ppb)*
Benzene	0.08	71432	0.343 - 0.754	0.29	0.33	0.39*	*0.35**
Carbon Tetrachloride	0.12	56235	0.140 - 0.140	0.06	0.06	0.06	*0.06*
Chloroform	0.19	67663	0.017 - 0.018	0.1	0.10	0.10	*0.10*
1,3-Dichloropropene	cis 0.28	542756	0.009 - 0.036	ND*	ND*	ND*	*ND**
1,3-Dichloropropene	trans 0.18			ND*	ND*	ND*	*ND**
Ethylene Dibromide (1,2-dibromoethane)	0.12	106934	0.001 - 0.001	ND*	ND*	ND*	*ND**
Ethylene Dichloride (1,2-dichloroethane)	0.08	107062	0.018 - 0.050	0.04	0.04	0.08	*0.04*
Methylene Chloride (dichloromethane)	0.10	75092	0.081 - 0.192	0.06	0.08*	0.07	*0.08**
Perchloroethylene (tetrachloroethene)	0.12	127184	0.031 - 0 062	.06*	0.06*	0.06*	*0.06**
Propylene Dichloride (1,2-dichloropropane)	0.15	78875	0.0000 - 0.0000	0.14	ND*	ND*	*ND**
1,1,2,2-Tetrachloroethane	0.07	79345	0.0000 - 0.0000	0.04	0.04	0.04	*0.04*
Trichloroethylene	0.16	79016	0.019 - 0.035	0.09	0.08	0.08	*0.08*
Vinyl Chloride	0.22	75014	0.0001 - 0.0005	0.11	0.11	0.11	*ND**

Pollutant	MDL (ppb)	CAS#	1996 NATA – Range of Annual Average Ambient Concentration Across all Lake County Census Tracts (ppb)	*East Chicago*** *(Long Term Site) Mean (ppb)*	Ogden Dunes (Long Term Site) Mean (ppb)	*Gary IITRI*** *(Long Term Site) Mean (ppb)*	Hammond CAAP (Long Term Site) Mean (ppb)
Benzene	0.08	71432	0.343 - 0.754	*0.31*	0.22	*0.83*	0.46*
Carbon Tetrachloride	0.12	56235	0.140 - 0.140	*0.07*	0.06	*0.06*	0.06
Chloroform	0.19	67663	0.017 - 0.018	*0.10*	0.09	*0.09*	0.10
1,3-Dichloropropene	cis 0.28	542756	0.009 - 0.036	*0.14*	ND*	*ND**	0.14
1,3-Dichloropropene	trans 0.18			*0.09*	0.09	*0.09*	0.09
Ethylene Dibromide (1,2-dibromoethane)	0.12	106934	0.001 - 0.001	*ND**	ND*	*ND**	ND*
Ethylene Dichloride (1,2-dichloroethane)	0.08	107062	0.018 - 0.050	*0.04**	0.04*	*0.04**	0.04*
Methylene Chloride (dichloromethane)	0.10	75092	0.081 - 0.192	*0.12**	0.05	*0.06*	0.07
Perchloroethylene (tetrachloroethene)	0.12	127184	0.031 - 0 062	*0.06**	0.06*	*0.06**	0.06*
Propylene Dichloride (1,2-dichloropropane)	0.15	78875	0.0000 - 0.0000	*0.24*	0.09	*0.07*	0.13
1,1,2,2-Tetrachloroethane	0.07	79345	0.0000 - 0.0000	*0.04*	0.04	*0.04*	0.04
Trichloroethylene	0.16	79016	0.019 - 0.035	*0.12*	0.13	*0.08*	0.08
Vinyl Chloride	0.22	75014	0.0001 - 0.0005	*0.11*	0.11	*0.11*	0.11

*** Bolded numbers reflect mean monitored values that fall with the range predicted in US EPA's NATA; ND = not detected; ** The East Chicago and Gary IITRI monitoring stations had less than 75% valid data return and are presented for informational purposes only.**

Summary

Based on this analysis, the NATA modeled values compared well (i.e., the monitored values fell within the range predicted by the model) with actual air quality monitoring data for three of the twelve common pollutants – benzene, 1,2-dibromoethane and dichloromethane. Three other pollutants compared well at selected monitoring stations – 1,3-dichloropropene, 1,1,2,2 tetrachloroethane and tetrachloroethylene.

The limitations inherent to comparing the NATA modeled values with actual air quality monitoring data, as discussed above, make using the modeled values as a basis for action or policy development inappropriate. However, these values, along with other information, may serve as a good screening tool for locating of air quality monitors, identifying areas for additional inventory development, and identifying areas for more detailed analysis.

PART III CONCLUSIONS AND RECOMMENDATIONS

Conclusions of the ToxWatch Study are presented in two ways. First, by reviewing how well the study did in meeting each of the intended goals. Second, by identifying overall conclusions of the study along with recommendations for future activities.

- **GOAL 1: Determine levels of selected toxic air pollutants in four urban areas in Indiana.**

Data were successfully collected and analyzed from air toxics monitoring stations in the four selected areas. For the most part, sufficient valid data (i.e., greater than 75% valid data return) were available from each monitoring station. These data provide OAQ with a better understanding of the ambient levels of the monitored toxic air pollutants and provides the foundation for additional assessment and work to reduce emissions of those toxic air pollutants presenting possible concern. OAQ continues to monitor at the longer-term (two-year) monitoring stations and has recently expanded the list of pollutants monitored to include formaldehyde and other toxic air pollutants.

The Washington Park monitoring station, located in Indianapolis (Marion County) has been enhanced into a regional 'Super Site.' This monitoring station will collect additional toxic air pollutant information (beyond the typical station) including an expanded list of pollutants.

Making the monitoring data and analysis information available to the public is very important. As part of this Study, OAQ established a ToxWatch webpage containing a description of the air toxics monitoring program, a description of this study, and links providing access to the monitoring data. Recent improvements to this webpage have made access to the monitoring data easier.

- **GOAL 2: Determine if the modeling projections used in federal air toxics studies could be used to reasonably predict ambient air toxics levels in areas where monitoring is not occurring.**

Based on this analysis, the NATA modeled values compared well with actual air quality monitoring data for three of the twelve common pollutants – benzene, 1,2-dibromoethane and dichloromethane. Three other pollutants compared well at selected monitoring stations – 1,3-dichloropropene, 1,1,2,2 tetrachloroethane and tetrachloroethylene.

NATA, along with other information, may serve as a good screening tool for locating air quality monitors, identifying areas for additional inventory development, and identifying areas for more detailed analysis. Further, as monitoring efforts continue and US EPA updates and refines the national-level studies, and more local assessment tools become available, the NATA modeling will become a more useful tool.

- **GOAL 3: Determine whether ambient concentrations of any of the monitored pollutants were concern enough to require further assessment or action.**

While the ToxWatch Study alone does not present sufficient information to identify which pollutants may present the greatest concern, used in conjunction with other tools, including TRI and US EPA's NATA, it assists in the task of identifying pollutants and geographic areas that warrant additional, more detailed analysis.

The aggregate relative hazard values indicated that the relative hazard for most of the study areas was comparable with the exception of Evansville, which had a significantly lower aggregate value.

Based on the ToxWatch Study, the following toxic air pollutants warrant further analysis, either statewide or within a specific urban area:

- Benzene
- Carbon tetrachloride
- Chloroform
- P-dichlorobenzene
- Chloromethane
- Trichloroethene

Additional information on the health effects and some of the common sources of these pollutants is available on the ToxWatch website,
http://www.IN.gov/idem/air/toxwatch/index.html

OAQ continues to assess ambient levels of these pollutants and possible sources of emissions, and is working to better characterize whether public health concerns exist in Indiana resulting from exposure.

RECOMMENDED NEXT STEPS

The ToxWatch Study serves as a good first step in the task of assessing ambient levels of toxic air pollutants. Continued monitoring and the addition of more pollutants are essential to OAQ's efforts to assess and reduce risks associated with exposure to toxic air pollutants.

As time goes on, the availability of data from other areas will allow OAQ to compare air toxics levels in Indiana with other areas of the country, and to make better judgments on what issues are local and what issues are common to other areas. This will lead to better capability for establishing public policy with respect to pollutants of concern.

Important tasks ahead include:

- The need to better correlate OAQ's air toxics monitoring with US EPA's Urban Air Toxics Strategy, which is the focus of NATA. This includes the addition of metals monitoring. Though limited by resources and availability of sampling methodologies for select toxic air pollutants, the more pollutants that the federal and state programs have in common, the more complete the analysis will be and the more effective reduction strategies can be.

- The need to further develop OAQ's air toxics modeling capabilities. This requires access to additional tools, such as refined air dispersion models capable of modeling toxic air pollutants. Modeling capabilities need to be developed on both a local and regional level.

- The need to develop better emissions inventories to identify sources emitting pollutants of concern and to improve air quality modeling capabilities.

- Use of the ToxWatch data, in conjunction with TRI and NATA, to identify priority pollutants and regions for additional assessment.

- Improved capabilities to incorporate special purpose monitoring (i.e., source oriented monitoring or based on identified public health concern) with the ongoing toxic air pollutant monitoring activities.

- Improved timing and capabilities to investigate short-term high monitored values closer to when they occur to attempt to identify possible influences, coupled with a more in depth analysis of these excursions.